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PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Earl B. Hoekman

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For : VEHICLE DETECTOR WITH ENVIRONMENTAL ADAPTATION

Docket No: 47241USA9A

I HEREBY CERTIFY THAT THIS CORRESPONDENCE IS BEING DEPOSITED WITH THE UNITED STATES POSTAL SERVICE AS FIRST CLASS MAIL IN AN ENVELOPE ADDRESSED TO: COMMISSIONER OF PATENTS AND TRADEMARKS, WASHINGTON, D. C. 20231, ON Sept 13, 1991

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SIGNED William B Barte

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INFORMATION DISCLOSURE STATEMENT

Commissioner of Patents and Trademarks
U.S. Patent and Trademark Office
Washington, D.C. 20231

Sir:

Applicant is aware of the patents which are listed on the attached Form PTOL-1449. Copies of the patents are enclosed.

Reference AA, the Koerner U.S. Patent 3,989,932, discloses an inductive loop vehicle detector. Oscillator circuitry is connected to a loop with the frequency of oscillation being determined by the loop inductance, which in turn is dependent on whether or not a vehicle is over the loop. Digital circuitry measures the time duration of a fixed number of loop oscillator cycles. A reduction in the measured time duration by an amount greater than a preselected threshold value produces an output signal indicative of a vehicle's presence.

Reference AB, the Koerner et al. U.S. Patent 3,943,339, discloses an inductive loop detector system. A common oscillator circuit is connected to each of a plurality of loops on a time-shared basis, with the frequency of oscillation being determined by the inductance of the connected loop. During each of multiple loop phases, a different one of the multiple loops is connected to the

oscillator circuitry, and during a period measurement portion of each loop phase the time duration of a number of loop oscillator cycles is measured. If the measured time duration is less than a reference duration by more than a preselected threshold, the detector produces an output signal indicative of the presence of a vehicle. The reference duration is varied in order to accommodate variations in loop inductance attributable to slowly varying environmental conditions.

Reference AC, the Hodge et al. U.S. Patent 4,472,706, discloses a vehicle presence loop detector. Multiple vehicle entries and exits from the vicinity of an inductive loop may be detected. The inductive loop and a tuned circuit generate electrical signals in response to changes in the inductive loop's magnetic field configuration as a result of the entrance or exit of a vehicle into or away from the proximity of the loop.

Reference AD, the Briefer U.S. Patent 4,949,054, discloses a temperature stable oscillator. The oscillator is coupled to a frequency control network having a series coupled inductance and sensor capacitor, a pair of cascaded capacitors, and an emitter follower amplifier. The emitter follower amplifier drives a current limiter in a feedback path, whereby the current through the emitter follower amplifier is divided between the current limiter and the feedback path in a manner establishing an oscillatory potential in the oscillator, while keeping the transistor of the emitter follower amplifier substantially out of its saturation state.

Reference AE, the Jefferis U.S. Patent 4,873,494, discloses an inductive loop presence detector with a cross-talk filter. An inductive loop acts as a frequency-determining element of an oscillator. Sensing circuitry detects changes in the loop oscillator frequency due to vehicle movement in the vicinity of the loop. The filter network inserted between the output of the loop oscillator and the sensing circuitry improves performance when

cross-talk occurs due to interference from other inductive loop detectors. The filter network may be comprised of a phase-locked loop incorporating a low pass filter to attenuate high frequency components due to cross-talk.

Reference AF, the Duley U.S. Patent 4,862,162, discloses a method of environmental tracking in inductive loop vehicle detection systems. Discrimination against variations in the inductance due to environmental changes is achieved by comparing detect and tracking reference numbers with a sample number which is a function of the oscillator frequency and updating each reference number at time intervals independent of loop oscillator frequency. If the difference between the tracking reference and the sample number is no greater than a threshold value, each reference is updated by repeatedly incrementing or decrementing it by a predetermined amount for a number of times determined by the time that has lapsed since the last comparison cycle. If the difference between the tracking reference and the sample number is greater than the threshold, indicating a vehicle movement, the tracking reference is made equal to the sample in one step.

Reference AG, the Koerner U.S. Patent 4,449,115, discloses an apparatus for detecting ferromagnetic material. A converter having an impedance responsive to the magnetic field intensity of the earth is used. The converter is an open magnetic structure having a non-linear BH curve biased by the earth's magnetic field. The open magnetic structure is a core of highly permeable material which approaches saturation under the influence of the earth's magnetic field, with the axis of the core at least partially aligned with a magnetic flux of the earth's magnetic field, and a coil wound around the axial core. The converter may be coupled to a detector for monitoring the impedance of the converter and generating a call signal responsive to the change in impedance.

Reference AH, the Dijkman U.S. Patent 4,368,428, discloses a method and arrangement for determining the velocity of a vehicle. A pair of inductive loops arranged in the road's surface, with each loop being the frequency determining element of an oscillator of first and second vehicle detectors. During a first predetermined measurement time interval for each detector, a measurement value is derived, in which the first measurement value exceeds a response threshold. For each detector, during a second predetermined measurement time interval, a second measurement value being below the response threshold is determined. The time at which each detector is activated is determined by interpolation between the first and second measurement values. The time between the determined activations of the first and second detectors, as well as the distance between the first and second inductive loops, is used to calculate vehicle speed.

Reference AI, the Duley et al. U.S. Patent 4,668,951, discloses an inductive loop vehicle detector. The vehicle detection apparatus has a plurality of channels, each channel having a respective loop oscillator, the frequency of which is dependent upon the inductance of the respective vehicle sensing inductive loop. A common computer performs calculations for each channel, and changes in the frequency of the respective loop oscillators are monitored. The computer calculates an operational number, and the time taken for that particular number of loop oscillator cycles to occur is measured. The measured value is compared with an environmental reference number to determine whether or not a vehicle has been detected.

Reference AJ, the Clark U.S. Patent 4,491,841, discloses a self-adjusting inductive object presence detector. In a vehicle detector with an inductive sensing loop that is a frequency-determining element of an oscillator, a first counter is operated to sample the oscillator frequency, and the count achieved is applied as a reference value to a second down counter which is

counted down in one sample period. The residue in the second counter at the end of the sample period is determinative of the presence of a vehicle. The first counter is updated every n^{th} sample period whereas the second counter is activated every sample period. Third and fourth counters are operated in the manner of the first and second counters in order to generate control signals used to adjust the first and third counters so as to reflect ambient changes during the vehicle presence.

Reference AK, the Clark et al. U.S. Patent 4,459,561, discloses a phase-lock loop controlled object detector oscillator. A vehicle detector includes a loop oscillator, the loop of which is locked in operation to a voltage controlled oscillator. The voltage controlled oscillator is incorporated in a phase-lock loop which is capable of locking to a multiple of a reference frequency oscillator. The phase-lock loop pulls the voltage controlled oscillator and therewith the loop oscillator to a multiple of the reference frequency. Vehicle detection is affected by a phase detector monitoring the phase difference between the loop oscillator and the voltage controlled oscillator.

While these references deal with inductive sensors, oscillators used in conjunction with the inductive sensors, inductive sensor detectors and applications of the inductive sensor detector, the references neither teach nor suggest, alone or in combination, the vehicle detector with environmental adaptation of the present invention.

Respectfully submitted,

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